

Test report

22-0188RP48-002

Product / EUT: *RFID Reader*
Type designation: *ARE i9x – hdx - SEMI*
Tested type: *ARE i9x – hdx – SEMI*
FCC-ID: *V7IAREI9XLF-S*

EUT authorization: ☒ Certification
☐ Suppliers Declaration of Conformity

Production level: *n/a*
S/N: *000560*
Manufacturer: *AEG Identifikationssysteme GmbH*
Hörvelsinger Weg 47
89081 Ulm / Germany

Test remit: FCC Rules 47 CFR Part 15 – Subpart C – Intentional radiators
in accordance with the procedures given in
ANSI C63.10-2013

The standards were: ☒ kept*
☐ not kept*

*Remark: ☒ Validation covered by the accredited scope
☐ Validation not covered by the accredited scope
according: _____
☐ Validation of the EMC-requirements partly proceeded

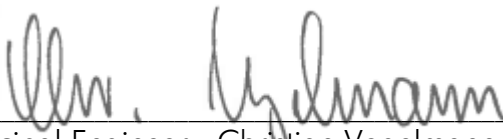


Applicant: AEG Identifikationssysteme GmbH
Hörvelsinger Weg 47
89081 Ulm / Germany

EUT-
Date of arrival: 11/15/2022
Test ID: 22-0188PR46-004
Date(s) of test: 11/25/2022, 11/28/2022

Burgrieden, 2023-01-10

Released by:


Principal Engineer - Christian Vogelmann

Test laboratory: EMCE GmbH
Ingenieurbüro für EMV-Prüfungen und
Schaltungsentwicklung
Untere Wiesen 1 / 88483 Burgrieden

DAkS-Registration No: D-PL-12122-01-01
D-PL-12122-01-02
D-PL-12122-01-03
D-PL-12122-01-04
CAB-Registration No.: BnetzA-CAB-02/21-01/1
FCC-Registration No.: 239304

Accredited by:

Bundesnetzagentur



Deutsche Akkreditierungsstelle GmbH



Responsible inspector: Mr. S. Vogelmann
EMCE GmbH
Ingenieurbüro für EMV-Prüfungen und Schaltungsentwicklung

Contact person: Mr. Leuthe / AEG Identifikationssysteme GmbH

EUT

Sampling: The device was selected and provided by the customer.

Description: *LF-RFID reader with a working frequency of 134.2 kHz for different LF algorithms: ISO 11784/11785 ARE i9 – LF
The reader is designed to be connected to an external antenna.*

Voltage supply: 120 V / 60 Hz

Frequency list: 134.2 kHz;

RF Application: 134.2 kHz

Temperature range: n/a

Size: *EUT (LxWxH) / mm: 85 x 40 x 25
Antenna (LxWxH) / mm: 45 x 30 x 10*

**Supplied /
used equipment:**

Designation	Type	Manufacturer	S/N
<i>Antenna (external)</i>	<i>AAN Xi9F flex 2m</i>	<i>AEG ID</i>	<i>108</i>
<i>RFID Tag</i>	<i>n/a</i>	<i>n/a</i>	<i>n/a</i>
<i>Notebook</i>	<i>W25CSW</i>	<i>Terra</i>	<i>n/a</i>
<i>Notebook Supply</i>	<i>A12-065N2A</i>	<i>Chicony</i>	<i>F134091506009041</i>
<i>RS232-to-USB adapter</i>	<i>n/a</i>	<i>IC Intracom Vertriebs GmbH</i>	<i>n/a</i>
<i>DC Supply (EUT)</i>	<i>APS 1612T</i>	<i>ANSMANN</i>	<i>n/a</i>

Supplied /
used software:

Cable designation	Type	Manufacturer	Version
<i>Software</i>	<i>Demo Terminal DL</i>	<i>AEG ID</i>	<i>V72</i>

Configuration:

☒

As-delivered condition*

☐

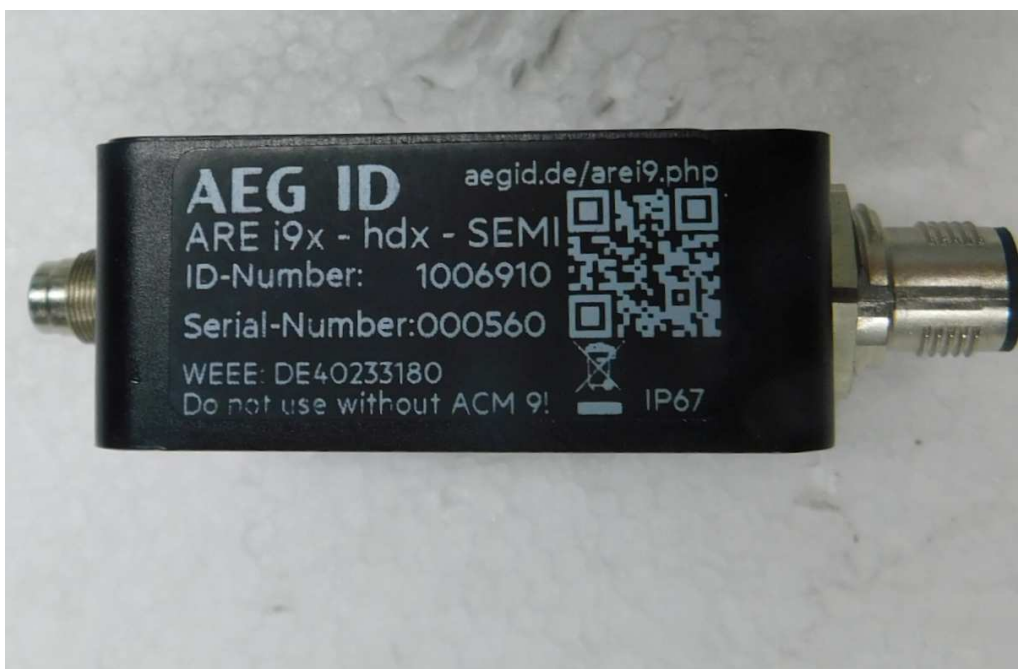
Modified*

*

Cable designation	Type	Length	Remarks
<i>AC Supply (EUT)</i>	<i>2 core</i>	<i>1.0 m</i>	<i>unshielded</i>
<i>DC Supply (EUT)</i>	<i>2 wires</i>	<i>2.2 m</i>	<i>unshielded</i>
<i>AC Supply (Notebook)</i>	<i>2 core</i>	<i>1.0 m</i>	<i>unshielded</i>
<i>DC Supply (Notebook)</i>	<i>2 core</i>	<i>1.8 m</i>	<i>unshielded</i>
<i>Antenna cable</i>	<i>3 core</i>	<i>2.0 m</i>	<i>unshielded</i>
<i>Interconnection cable</i>	<i>4 core</i>	<i>3.2 m</i>	<i>unshielded</i>



Pictures of the EUT:





Remarks: n/a

State of revision:

Source document	New Document	Date / Reviser	Modifications

Test equipment list of EMCE GmbH:

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007	1 Year(s)/ 2023-02-10
004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003	1 Year(s)/ 2023-02-10
006	LISN	NNBM 8125	Schwarzbeck	8125371	1 Year(s)/ 2023-02-28
007	Absorbing clamp	MDS 21	Schwarzbeck	942436	1 Year(s)/ 2023-01-15
008	Antenna 9kHz - 30MHz	HFH2-Z2	Rohde & Schwarz	835776/0002	3 Year(s)/ 2025-11-20
009	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	435	3 Year(s)/ 2024-12-22
011	Antenna 30-300MHz	VHBA9123 / BBA9106	Schwarzbeck	0403/94	3 Year(s)/ 2023-01-31
014	OATS	Test site 3 m referred to ANSI C63.4-2014	EMCE GmbH		3 Year(s)/ 2024-04-23
015	OATS	Test site 10 m referred to ANSI C63.4-2014	EMCE GmbH		3 Year(s)/ 2024-04-26
042-2	AC-Source	EMV D 5000/PAS/SyCore	Spitzenberger & Spies	A274700 / 00501	3 Year(s)/ 2023-01-30
042-1	Analyser Reference System	ARS 16/3	Spitzenberger & Spies	A274707 / 00501	3 Year(s)/ 2024-12-28
043	Receiver	3DH/E Fieldmeter ESM-100	Maschek	971521	3 Year(s)/ 2023-08-13
058	Receiver	ESIB 40	Rohde & Schwarz	100200/ Firmware 4.35	1 Year(s)/ 2023-08-02
059	Log.-per. antenna	HL050	Rohde & Schwarz	100006	3 Year(s)/ 2025-10-21
062-2	Semi-Anechoic Chamber 13.5x6.1x5.5 m	30 - 1000 MHz referred to ANSI C63.4-2014	EMC-Technik & Consulting GmbH		3 Year(s)/ 2024-01-31
062-1	Semi-Anechoic Chamber 13.5x6.1x5.5 m	1 - 18 GHz referred to CISPR16 1-4: 2010-04 Ed. 3	EMC-Technik & Consulting GmbH		3 Year(s)/ 2024-05-14
067	LISN	ESH2-Z5	Rohde & Schwarz	872460/043	1 Year(s)/ 2023-02-10

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
068	LISN	ESH2-Z5	Rohde & Schwarz	872460/042	1 Year(s)/ 2023-02-10
070	Pulse limiter + 10 dB Attenuator	ESH3-Z2	Rohde & Schwarz	n/a	1 Year(s)/ 2023-08-31
073	Absorbing clamp	MDS21	Schwarzbeck	881757	1 Year(s)/ 2023-01-15
116	Vertical rod antenna	VAMP 9243	Schwarzbeck	9243-205	3 Year(s)/ 2023-02-19
117	LISN	ESH3-Z6	Rohde & Schwarz	100521	1 Year(s)/ 2023-02-28
174	LISN	ESH3-Z6	Rohde & Schwarz	101003	1 Year(s)/ 2023-02-28
175	EMI Test receiver	ESR7	Rohde & Schwarz	101108 Firmware: FW V3.46 SP3	1 Year(s)/ 2023-11-18
178	V-LISN 5 μ H	NNHV 8123-400	Schwarzbeck	018	1 Year(s)/ 2023-02-28
184	V-LISN 5 μ H	NNHV8123-400	Schwarzbeck	019	1 Year(s)/ 2023-02-28
211	Broadband Amplifier	BBA150 800 - 3000 MHz	Rohde & Schwarz	102104	1 Year(s)/ 2023-01-31
212	Broadband Amplifier	BBA150 2500 - 6000 MHz	Rohde & Schwarz	102105	1 Year(s)/ 2023-01-31
222	Broadband Preamplifier 0.5- 18GHz	BBV 9718	Schwarzbeck	9718-316	1 Year(s)/ 2023-05-31
223	Broadband Preamplifier 12- 28GHz	BBV 9719	Schwarzbeck	9719-024	1 Year(s)/ 2023-05-31
224	SMB100A Signal Generator	SMB100A	Rohde & Schwarz	108055	3 Year(s)/ 2023-01-20
225	Electric and Magnetic Field Probe-Analyzer	EHP-200A	Narda S.T.S. / PMM	170WX70205	3 Year(s)/ 2025-07-22
228	Coupling device network AF4	CDN AF4-32	EMCE GmbH		1 Year(s)/ 2023-02-28
229	Test receiver	ESS 5 Hz - 1000 MHz	Rohde & Schwarz	845420/0005	1 Year(s)/ 2022-12-13
230	FSV40 Signal Analyzer 40 GHz	FSV40	Rohde & Schwarz	101717	2 Year(s)/ 2024-02-23
231	Vector Signal Generator SMBV100A	SMBV100A	Rohde & Schwarz	262891	3 Year(s)/ 2023-10-02
233	OSP-B157W 8 PORT	OSP-B157W8	Rohde & Schwarz	100925	2 Year(s)/ 2024-02-25

Inv.-No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
235	ESD-Gun	NSG 435	Teseq	7275	2 Year(s)/ 2024-10-26
236	Broad-Band Horn Antenna 0.5-6 GHz	BBHA 9120 E	Schwarzbeck	00831	5 Year(s)/ 2024-02-13
237	Exposure Level Tester	ELT-400	Narda Safety Test Solutions	O-0028	3 Year(s)/ 2023-02-06
239	Broadband Horn Antenna 15-40 GHz	BBHA 9170	Schwarzbeck	00932	5 Year(s)/ 2024-05-23
240	Broadband Preamplifier 18-40 GHz	BBV 9721	Schwarzbeck	54	1 Year(s)/ 2023-05-31
253	Broadband Preamplifier 20-1000 MHz	ESV-Z3	Rohde & Schwarz	881 909/030	1 Year(s)/ 2023-08-31
257	Pulse limiter + 10 dB Attenuator	ESH3-Z2	Rohde & Schwarz	102769	1 Year(s)/ 2023-08-31
262	EM Clamp	KEMZ 801A	Teseq	78033	1 Year(s)/ 2023-08-31
718	EMC-Software	BAT-EMC Vers. 3.18.0.19	Nexio	n/a	
997	EMC Software	EMC32 Vers. 10.60.20	Rohde & Schwarz	n/a	
1212	EMC Software	WMS32 Vers. 10.60.20	Rohde & Schwarz	n/a	
8000	Artificial Network	AN 200N100	Ametek	P1410132431	1 Year(s)/ 2023-02-28
8004	Broadband Preamplifier 18-40 GHz	BLMA 1840-5G	BONN Elektronik GmbH	2113300	1 Year(s)/ 2023-05-31
8007	Logarithmic Periodic Broadband Antenna 180 - 1500 MHz	VULP 9118A	Schwarzbeck	899	3 Year(s)/ 2024-10-27
8008	Logarithmic Periodic Broadband Antenna 180 - 1500 MHz	VULP 9118A	Schwarzbeck	900	3 Year(s)/ 2024-10-27
8009	Field Monitoring Loop	FESP 5134-1	Schwarzbeck	00078	3 Year(s)/ 2024-12-20
8013	Antenna 9 - 150 kHz	Ø 120 mm, 20 Turns	EMCE GmbH	n/a	
8015	Amplifier 2.5 - 6 GHz	BBA150-E100	Rohde & Schwarz	105302	1 Year(s)/ 2023-05-31
8016	Circular Loop Antenna 0.01 - 120 MHz	HFRA 5164	Schwarzbeck	00152	



Inv.- No.	Designation	Type	Manufacturer	S/N	Calibration: Interval /valid until
8017	Compensation network for 13.56 MHz	NFCN 1356	Schwarzbeck	00122	
8018	Field Probe	EP-601	Narda	811ZX20438	1 Year(s)/ 2023-08-16



Scope:

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1 Test(s) according 47 CFR Part 15 Subpart C - 11/25/2022

1.1 Requirements and conformance test specifications

Standard

47 CFR Part 15 Subpart C

ANSI C63.10-2013

KDB n/a

-

Test mode application		
☒	Antenna requirement	§ 15.203
☒	Restricted bands of operation	§ 15.205 (a) (b) (c)
☒	Terminal voltage on powerline	§ 15.207 (a)
☒	Radiated emissions H-Field of intentional radiators	§ 15.209 (a) (b) (c) (d) (e) (f)
☒	Radiated emissions E-Field of intentional radiators	§ 15.209 (a) (b) (c) (d) (e) (f)

1.2 Antenna requirements

- ☒ No deviation from the standard
- ☐ Deviation from the standard*
- ☐ Test not requested*
- ☐ Test not carried out*

*

Measurement procedure:
Rules and specification
Guide

47 CFR Part 15 Section 15.203
n/a

Requirement:

- ☐ Permanent attached
- ☒ Unique coupling to the intentional radiator

Test result

Requirement:

- ☒ kept
- ☐ not kept

Authorized antenna:

- ☐ Print antenna
- ☐ Internal antenna
- ☒ External antenna - *AAN Xi9F flex 2m*

| Remarks: n/a

1.3 Restricted bands of operation

- ☒ No deviation from the standard
☐ Deviation from the standard*
☐ Test not requested*
☐ Test not carried out*

*

Requirement: 47 CFR Part 15 Section 15.205 (a)(b)(c)
 Guide n/a

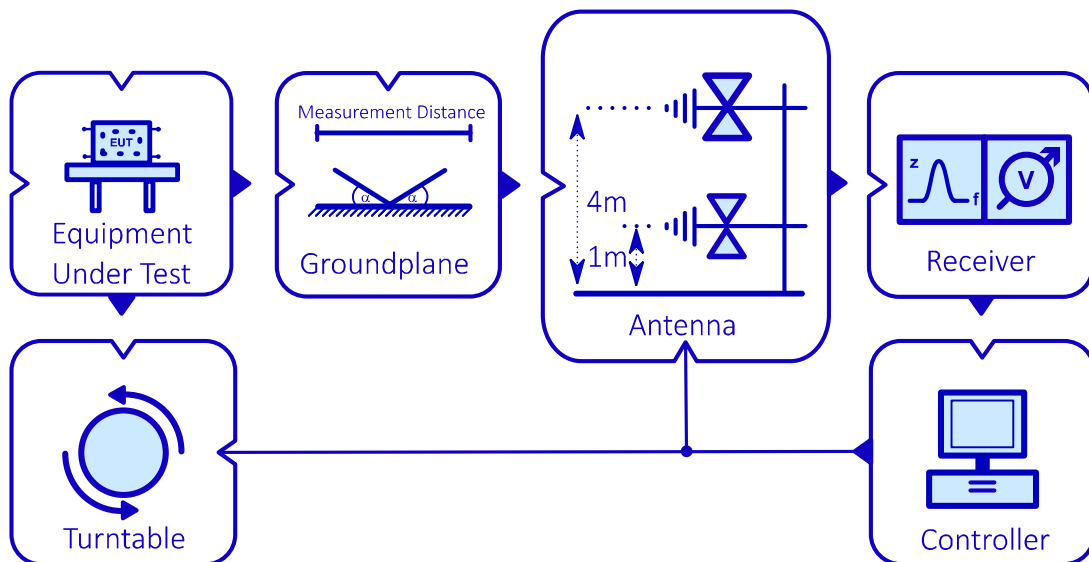
Restricted bands

f / MHz	f / MHz	f / MHz	f / GHz
0.090-0.110	37.5-38.25	3345.8-3358	9.0-9.2
0.495 – 0.505	73-74.6	3500-4400	9.3-9.5
2.1735-2.1905	74.8-75.2	4500-5150	10.6-12.7
3.020-3.026	108-138	5350-5460	13.25-13.4
4.125-4.128	149.9-150.05	7250-7750	14.47-14.5
4.17725-4.17775	156.52475-156.52525	8025-8500	15.35-16.2
4.20725-4.20775	156.7-156.9		17.7-21.4
5.677-5.683	162.0125-167.17		22.01-23.12
6.215-6.218	167.72-173.2		23.6-24.0
6.26775-6.26825	240-285		31.2-31.8
6.31175-6.31225	322-335.4		36.43-36.5
8.291-8.294	399.9-410		above 38.6
8.362-8.366	608-614		
8.37625-8.38675	960-1427		
8.41425-8.41475	1435-1626.5		
12.29-12.293	1645.5-1646.5		
12.51975-12.52025	1660-1710		
12.57675-12.57725	1718.8-1722.2		
13.36-13.41	2200-2300		
16.42-16.423	2310-2390		
16.69475-16.69525	2655-2900		
16.80425-16.80475	3260-3267		
25.5-25.67	3332-3339		

Only spurious emissions are permitted in any of the frequency bands listed before. The field strength of emissions appearing within these frequency bands shall not exceed the radiated emission limits; general requirements. At frequencies equal to or less than 1000 MHz, compliance with the radiated emission limits; general requirements shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions.

Basic structure - Setup

OATS / SAC





1.3.1 Test set up

See test for radiated emissions of intentional radiators.

Test location

See test for radiated emissions of intentional radiators.

Used test equipment

See test for radiated emissions of intentional radiators.

1.3.2 Test

Rules and specification 47 CFR Part 15 Section 15.205 (a)(b)(c)

Highest frequency generated or used in the device or on which the device operates or tunes:

- ☐ < 1.705 MHz
☒ 1.705 – 108 MHz
☐ 108 – 500 MHz
☐ 500 – 1000 MHz
☐ > 1000 MHz

Upper frequency of measurement:

- ☐ 30 MHz
☒ 1000 MHz
☐ 2000 MHz
☐ 5000 MHz
☐ 5. harmonic of the highest frequency or 40 GHz, whichever is lower

Used frequency band: ☒ 0.119 – 0.140 MHz

Nearest restricted band: ☒ 0.090 - 0.110 MHz

Frequency range:

☒ 9 kHz – 30 MHz
☐ 1 – 5 GHz
☐ 18 – 26 GHz

☒ 30 MHz – 1000 MHz
☐ 5 – 18 GHz
☐ 26 – 40 GHz

Limits for radiated emissions in the restricted bands

Technical requirements			
Detector	Frequency / MHz	Limit / $\mu\text{V/m}$	Measurement distance / m
AV	0.009 – 0.09	2400/F(kHz)	300
QP	0.09 – 0.110	2400/F(kHz)	300
AV	0.110 – 0.49	2400/F(kHz)	300
QP	0.49 – 1.705	24000/F(kHz)	30
QP	1.705 – 30.0	30	30
Detector	Frequency / MHz	Limit / $\text{dB}\mu\text{V/m}$	Measurement distance / m
QP	30.0 – 88.0	40.0	3
QP	88.0 – 216.0	43.5	3
QP	216.0 – 960.0	46.0	3
QP	960.0 – 1000.0	54.0	3
AV	> 1000	54.0	3
PK	> 1000	74.0	3

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.



Test procedure

See test for radiated emissions of intentional radiators.

Test result

Used frequency range outside of restricted bands

☒ kept
☐ not kept

General emission limits for restricted frequency bands:

☒ kept
☐ not kept

See test for radiated emissions of intentional radiators.

Limits for next restricted frequency band:

☒ kept
☐ not kept

| Remarks: n/a



1.4 Terminal voltage on AC power-line

- ☒ No deviation from the standard
- ☐ Deviation from the standard*
- ☐ Test not requested*
- ☐ Test not carried out*

*

Measurement procedure:

Rules and specification

47 CFR Part 15 Section 15.207 (a)

Guide

ANSI C63.10-2013

The conducted disturbances are recorded in the frequency range from 150 kHz to 30 MHz. For this purpose line impedance stabilization networks (LISNs) are used which are inserted between the DUT and the mains supply. The output of one LISN is connected directly to a receiver according to CISPR 16 guidelines via a pulse limiter and 10 dB fixed attenuator. Not used ports of the LISN are terminated by 50 Ω . The Average- and Quasi-Peak-Detectors are provided to evaluate the spectrum. To speed up the measurement process, a pre-measurement is performed with the Peak- and Average-Detectors. The 10 frequencies with the smallest distance to the limit and priority with the highest exceeding are selected and re-measured. The Average and Quasi-Peak-Detectors are used for the final measurement. This measurement procedure is performed for each individual current conductor.

Depending on the limit lines, 6 final measurements are documented. The highest limit exceeding or, in case of compliance with the limit, the emissions found with the smallest distance to the limit are documented.

If less than six emission frequencies with a distance of 20 dB are below the limit value, the noise level of the measuring device at representative frequencies is indicated.

For the measurement, it may be necessary to terminate the antenna output to distinguish the interference level caused by the unintentional part from the intentional part (see ANSI C63.4 section 13.1.3.1).

The documented final test results are calculated using the following formula:

$$U_{(f)} \text{ (dB}\mu\text{V)} = \text{Measured Value (dB}\mu\text{V)} + \text{ATF (dB)} + \text{CF (dB)}$$

$U_{(f)}$ =	Final result of the terminal voltage at the test frequency
Reading =	Uncorrected measured value
ATF =	Correction factor for the pulse limiter + 10 dB attenuator
CF =	Correction factor for the cable attenuation

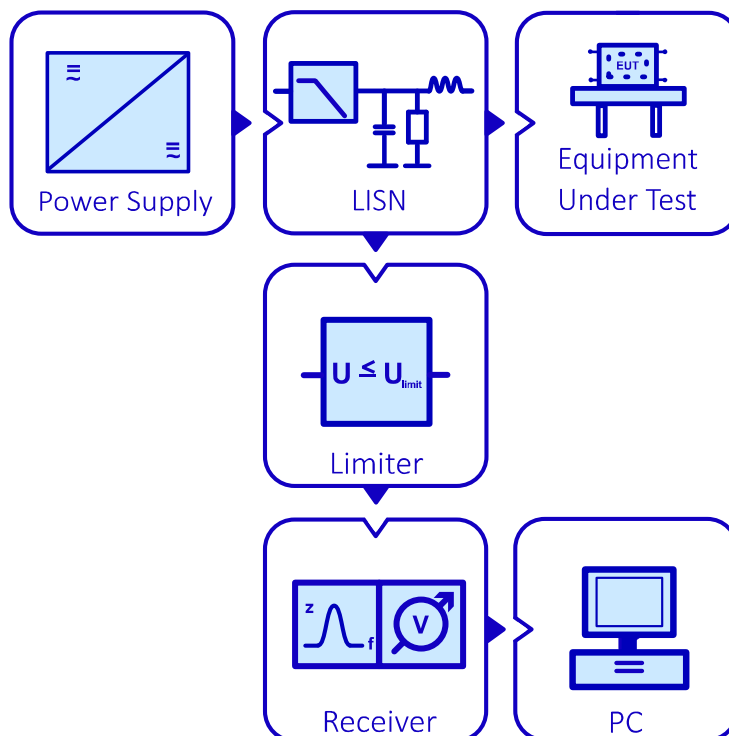
Example:

Test frequency	13.56 MHz
Reading	31.5 dB μ V
AFT _(13.56 MHz)	10.2 dB
CF _(13.56 MHz)	0.4 dB

Calculated final result for the terminal voltage $u(f)$:

$$U_{(13.56 \text{ MHz})} = 31.5 \text{ dB}\mu\text{V} + 10.2 \text{ dB} + 0.4 \text{ dB} = 42.1 \text{ dB}\mu\text{V}$$

Basic structure - Setup





1.4.1 Test set up

According ANSI C63.10-2013



Test location

☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	588	Shielded room # 2	8.3/5.8 x 5.5/2.9 x 3.4 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	1319	Shielded room #5	5.6 x 5.0 x 3.8 m	Albatross Projects GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

☒	Inv.-No.	Designation	Type	Manufacturer	S/N
	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
	003	LISN 1	ESH3-Z5	Rohde & Schwarz	835268/007
☒	004	LISN 2	ESH3-Z5	Rohde & Schwarz	835268/003
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	067	LISN 5	ESH2-Z5	Rohde & Schwarz	0872460/043
☒	068	LISN 4	ESH2-Z5	Rohde & Schwarz	0872460/042
☒	070	Pulse limiter / 10 dB attenuator	ESH3-Z2	Rohde & Schwarz	357.8810.52
☒	229	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	845420/0005
☒	997	Software	EMC32	Rohde & Schwarz	n/a

All used test equipment are checked resp. calibrated periodically.

☒ Test equipment was checked and complied to the requirements



Test-/Measurement uncertainty

The measurement uncertainty in the test met the guideline of CISPR16-4-2 or better.

Measurement uncertainty of the terminal voltage with an extended coverage factor of $k = 2$:

Frequency	Measurement uncertainty
9 kHz – 150 kHz	4.0 dB
150 kHz – 30 MHz	3.6 dB

1.4.2 Test

Requirement 47 CFR Part 15 Section 15.207 (a)

Frequency range: 150 kHz – 30 MHz

Limits for conducted emissions

Technical requirements			
Detector	Frequency / MHz	Limit QP-Detector / dB μ V	Limit AV-Detector / dB μ V
QP AV	0.15 – 0.5	66.0 – 56.0	56.0 – 46.0
QP AV	0.5 – 5.0	56.0	46.0
QP AV	5.0 – 30.0	60	50.0

Rationale for selecting the EUT test set up

Equipment units:

EUT with external antenna, external power supply and evaluation unit.

Cabling:

- ☒ Standard cables
☐ Special cables provided by the manufacturer

Port #	Designation	Remarks
# 1	AC power line - EUT	L1/N
# 2	AC power line - AE	L1/N

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120 V/60 Hz ☐ 240 V/60 Hz

Continuous operation with the maximum permitted reading speed according customer specification. The reader was operated without a tag.



Environmental conditions

Temperature [10 – 40 °C]:

24 °C

Relative humidity [10 – 90 %]:

36 %

Environmental conditions during the test:

☒ kept

☐ not kept

Test result

Limits for conducted powerline emissions:

☒ kept

☐ not kept

| Remarks: n/a

Protocol scope

☒ Readings – emissions for EUT

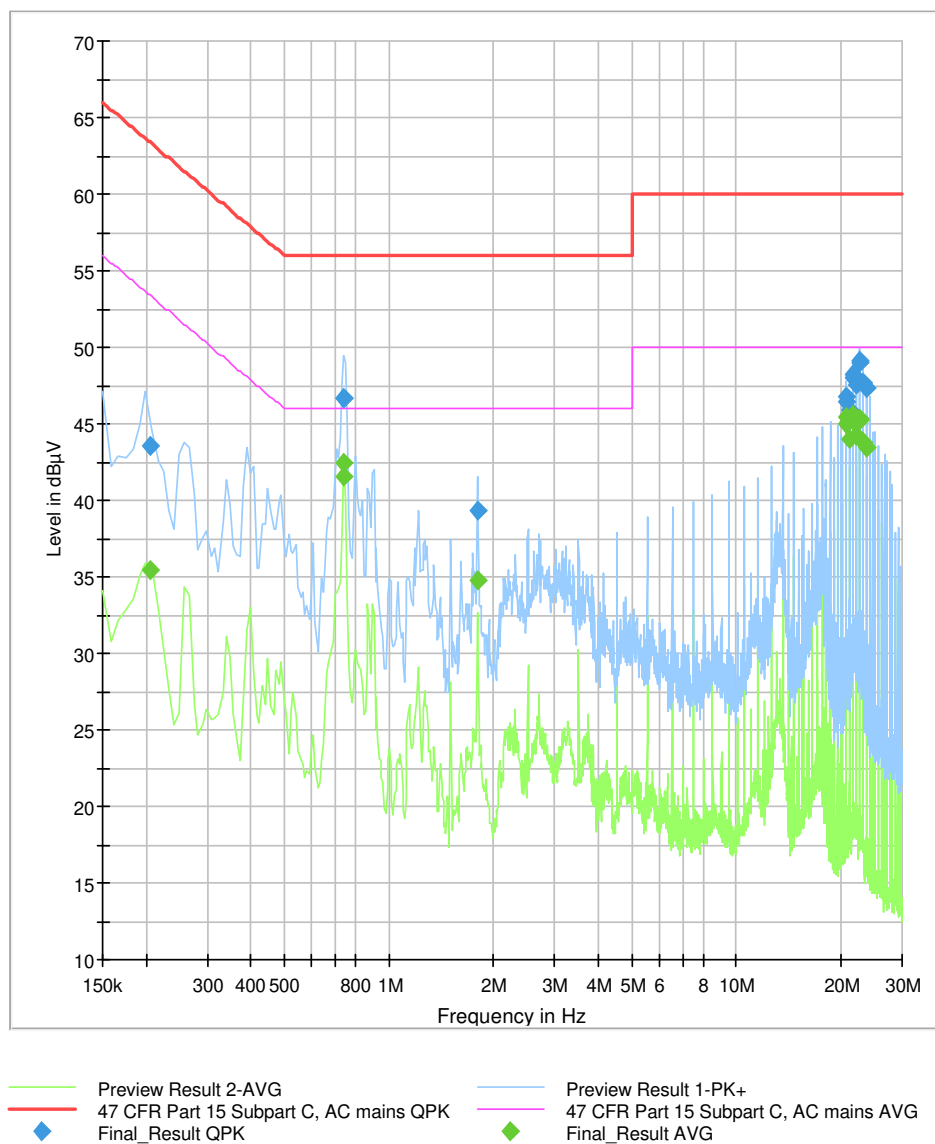
☒ Diagrams - emissions for EUT

☒ Readings - emissions for AE

☒ Diagrams - emissions for AE

EUT Information

EUT Name:	ARE i9x - hdx - SEMI
Test_ID: / SN:	22-0188PR46-004
Customer:	AEG ID GmbH
Operational condition:	Testmode, max. perm. customer reading speed; without Tag
Test specification:	47 CFR Part 15 Subpart C Section 15.207 (a)
LISN port	N (EUT)
Operator:	S. Vogelmann
File #:	22-0188RC47-004-016
Comment #1:	Supply:120 V/ 60 Hz
Comment #2:	

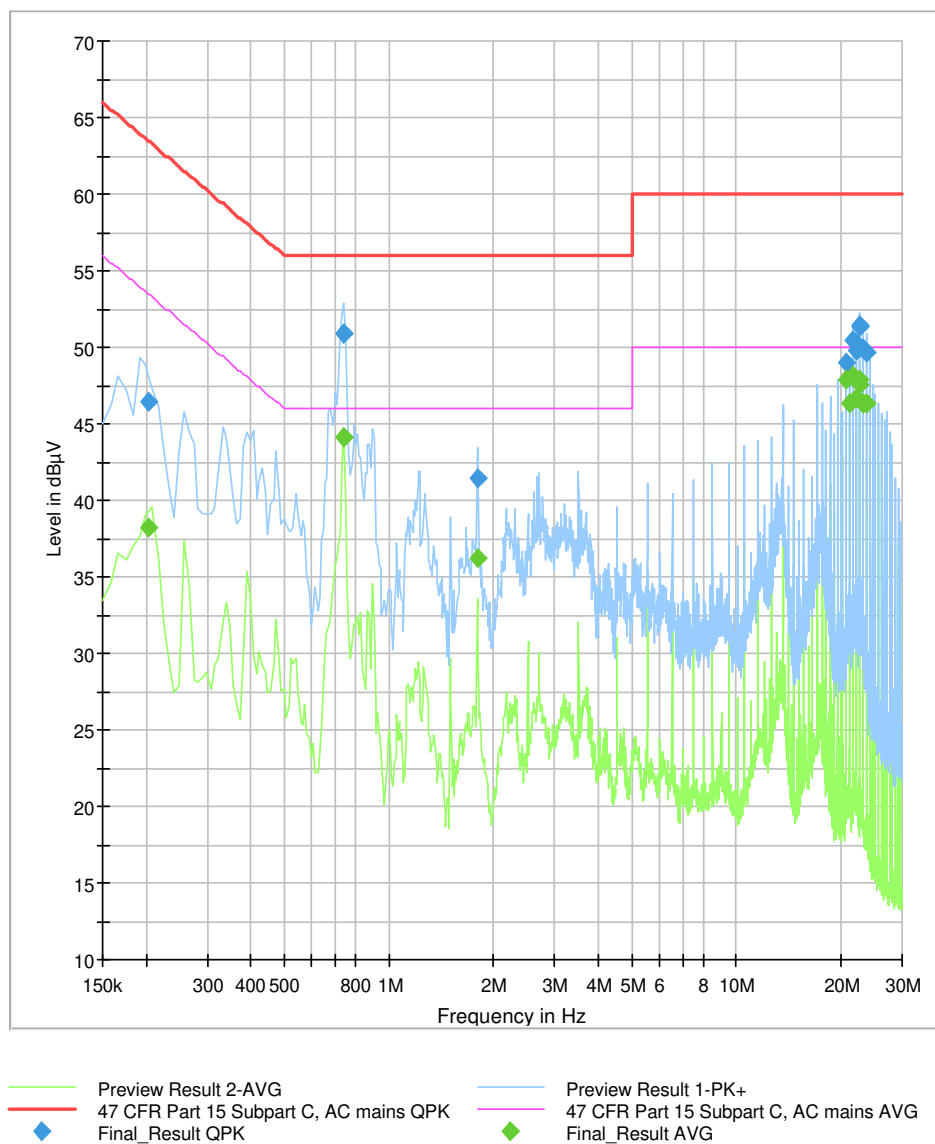


Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.205492	---	35.41	53.39	17.98	15000.0	9.000	N	10.1
0.205492	43.55	---	63.39	19.84	15000.0	9.000	N	10.1
0.740754	---	41.54	46.00	4.46	15000.0	9.000	N	10.2
0.740754	46.68	---	56.00	9.32	15000.0	9.000	N	10.2
0.744072	---	42.48	46.00	3.52	15000.0	9.000	N	10.2
0.744072	46.63	---	56.00	9.37	15000.0	9.000	N	10.2
1.808676	---	34.75	46.00	11.25	15000.0	9.000	N	10.2
1.808676	39.30	---	56.00	16.70	15000.0	9.000	N	10.2
20.622347	---	45.39	50.00	4.61	15000.0	9.000	N	10.9
20.622347	46.78	---	60.00	13.22	15000.0	9.000	N	10.9
20.623337	---	45.01	50.00	4.99	15000.0	9.000	N	10.9
20.623337	46.46	---	60.00	13.54	15000.0	9.000	N	10.9
21.125379	---	43.98	50.00	6.02	15000.0	9.000	N	11.0
21.125379	45.92	---	60.00	14.08	15000.0	9.000	N	11.0
21.629646	---	45.54	50.00	4.46	15000.0	9.000	N	11.0
21.629646	48.17	---	60.00	11.83	15000.0	9.000	N	11.0
21.630288	---	45.24	50.00	4.76	15000.0	9.000	N	11.0
21.630288	48.01	---	60.00	11.99	15000.0	9.000	N	11.0
22.131580	---	44.18	50.00	5.82	15000.0	9.000	N	11.0
22.131580	47.54	---	60.00	12.46	15000.0	9.000	N	11.0
22.635056	---	45.24	50.00	4.76	15000.0	9.000	N	10.9
22.635056	49.04	---	60.00	10.96	15000.0	9.000	N	10.9
22.635380	---	45.35	50.00	4.65	15000.0	9.000	N	10.9
22.635380	49.16	---	60.00	10.84	15000.0	9.000	N	10.9
23.137818	---	43.77	50.00	6.23	15000.0	9.000	N	10.9
23.137818	47.71	---	60.00	12.29	15000.0	9.000	N	10.9
23.641095	---	43.46	50.00	6.54	15000.0	9.000	N	10.9
23.641095	47.31	---	60.00	12.69	15000.0	9.000	N	10.9

EUT Information

EUT Name:	ARE i9x - hdx - SEMI
Test_ID: / SN:	22-0188PR46-004
Customer:	AEG ID GmbH
Operational condition:	Testmode, max. perm. customer reading speed; without Tag
Test specification:	47 CFR Part 15 Subpart C Section 15.207 (a)
LISN port	L1 (EUT)
Operator:	S. Vogelmann
File #:	22-0188RC47-004-018
Comment #1:	Supply:120 V/ 60 Hz
Comment #2:	

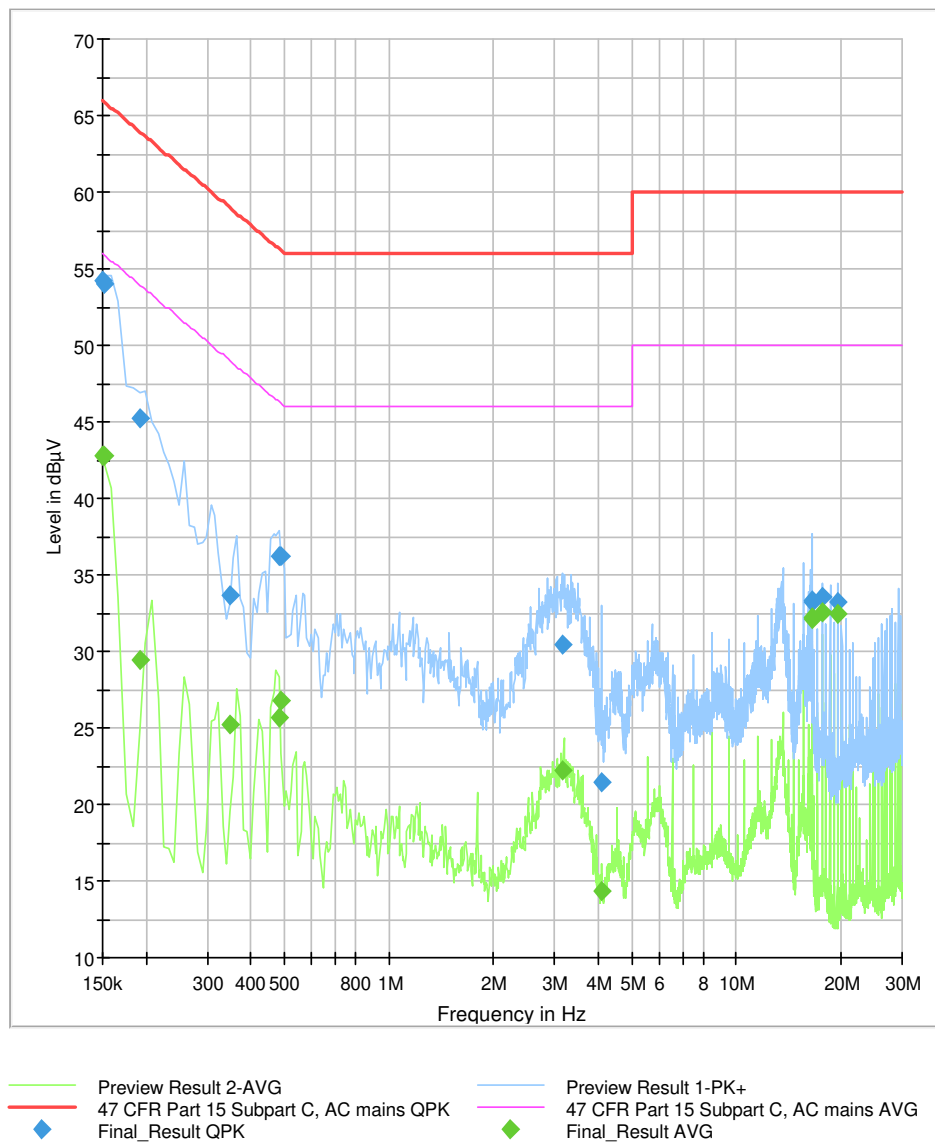


Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.204178	---	38.18	53.44	15.26	15000.0	9.000	L1	10.1
0.204178	46.45	---	63.44	16.99	15000.0	9.000	L1	10.1
0.739188	---	44.10	46.00	1.90	15000.0	9.000	L1	10.1
0.739188	50.87	---	56.00	5.13	15000.0	9.000	L1	10.1
0.739422	---	44.12	46.00	1.88	15000.0	9.000	L1	10.1
0.739422	50.91	---	56.00	5.09	15000.0	9.000	L1	10.1
1.806971	---	36.19	46.00	9.81	15000.0	9.000	L1	10.2
1.806971	41.48	---	56.00	14.52	15000.0	9.000	L1	10.2
20.624153	---	47.91	50.00	2.09	15000.0	9.000	L1	10.9
20.624153	49.05	---	60.00	10.95	15000.0	9.000	L1	10.9
21.126231	---	46.37	50.00	3.63	15000.0	9.000	L1	10.9
21.126231	48.12	---	60.00	11.88	15000.0	9.000	L1	10.9
21.629982	---	48.07	50.00	1.93	15000.0	9.000	L1	11.0
21.629982	50.48	---	60.00	9.52	15000.0	9.000	L1	11.0
21.630366	---	48.06	50.00	1.94	15000.0	9.000	L1	11.0
21.630366	50.41	---	60.00	9.59	15000.0	9.000	L1	11.0
22.132354	---	46.68	50.00	3.32	15000.0	9.000	L1	11.0
22.132354	49.73	---	60.00	10.27	15000.0	9.000	L1	11.0
22.636478	---	47.60	50.00	2.40	15000.0	9.000	L1	10.9
22.636478	51.32	---	60.00	8.68	15000.0	9.000	L1	10.9
22.636640	---	47.88	50.00	2.12	15000.0	9.000	L1	10.9
22.636640	51.45	---	60.00	8.55	15000.0	9.000	L1	10.9
23.137284	---	46.34	50.00	3.66	15000.0	9.000	L1	10.9
23.137284	49.92	---	60.00	10.08	15000.0	9.000	L1	10.9
23.139150	---	46.36	50.00	3.64	15000.0	9.000	L1	10.9
23.139150	49.90	---	60.00	10.10	15000.0	9.000	L1	10.9
23.642319	---	46.37	50.00	3.63	15000.0	9.000	L1	10.9
23.642319	49.69	---	60.00	10.31	15000.0	9.000	L1	10.9

EUT Information

EUT Name:	ARE i9x - hdx - SEMI
Test_ID: / SN:	22-0188PR46-004
Customer:	AEG ID GmbH
Operational condition:	Testmode, max. perm. customer reading speed; without Tag
Test specification:	47 CFR Part 15 Subpart C Section 15.207 (a)
LISN port	N (AE)
Operator:	S. Vogelmann
File #:	22-0188RC47-004-016
Comment #1:	Supply:120 V/ 60 Hz
Comment #2:	

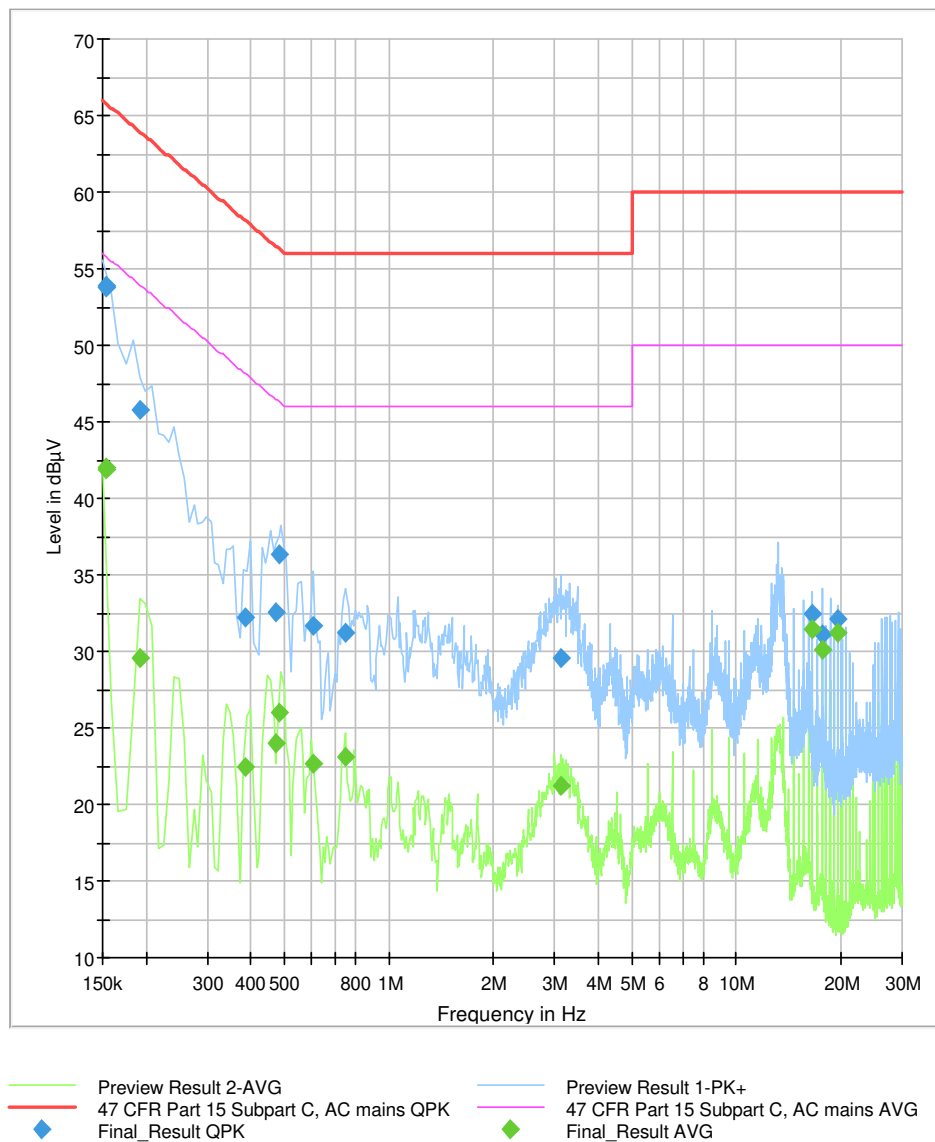


Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.150213	---	42.80	55.99	13.18	15000.0	9.000	N	10.0
0.150213	54.17	---	65.99	11.82	15000.0	9.000	N	10.0
0.151354	---	42.73	55.93	13.20	15000.0	9.000	N	10.0
0.151354	54.01	---	65.93	11.91	15000.0	9.000	N	10.0
0.191290	---	29.46	53.98	24.52	15000.0	9.000	N	10.0
0.191290	45.24	---	63.98	18.74	15000.0	9.000	N	10.0
0.349533	---	25.21	48.97	23.76	15000.0	9.000	N	10.1
0.349533	33.63	---	58.97	25.34	15000.0	9.000	N	10.1
0.483881	---	25.68	46.27	20.59	15000.0	9.000	N	10.1
0.483881	36.18	---	56.27	20.09	15000.0	9.000	N	10.1
0.486095	---	26.73	46.23	19.50	15000.0	9.000	N	10.1
0.486095	36.24	---	56.23	19.99	15000.0	9.000	N	10.1
3.148103	---	22.20	46.00	23.80	15000.0	9.000	N	10.3
3.148103	30.39	---	56.00	25.61	15000.0	9.000	N	10.3
4.093665	---	14.33	46.00	31.67	15000.0	9.000	N	10.3
4.093665	21.42	---	56.00	34.58	15000.0	9.000	N	10.3
16.598051	---	32.06	50.00	17.94	15000.0	9.000	N	10.8
16.598051	33.17	---	60.00	26.83	15000.0	9.000	N	10.8
16.598387	---	32.24	50.00	17.76	15000.0	9.000	N	10.8
16.598387	33.31	---	60.00	26.69	15000.0	9.000	N	10.8
17.603766	---	32.59	50.00	17.41	15000.0	9.000	N	10.8
17.603766	33.58	---	60.00	26.42	15000.0	9.000	N	10.8
19.615833	---	32.45	50.00	17.55	15000.0	9.000	N	10.9
19.615833	33.18	---	60.00	26.82	15000.0	9.000	N	10.9

EUT Information

EUT Name:	ARE i9x - hdx - SEMI
Test_ID: / SN:	22-0188PR46-004
Customer:	AEG ID GmbH
Operational condition:	Continuous reading with max perm. customer reading speed, no Tag
Test specification:	47 CFR Part 15 Subpart C Section 15.207 (a)
LISN port	L1 (AE)
Operator:	S. Vogelmann
File #:	22-0188RC47-004-016
Comment #1:	Supply:120 V/ 60 Hz
Comment #2:	



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.152565	53.94	---	65.86	11.92	15000.0	9.000	L1	10.0
0.152565	---	42.04	55.86	13.82	15000.0	9.000	L1	10.0
0.153138	53.80	---	65.83	12.03	15000.0	9.000	L1	10.0
0.153138	---	41.88	55.83	13.95	15000.0	9.000	L1	10.0
0.191332	45.81	---	63.98	18.17	15000.0	9.000	L1	10.0
0.191332	---	29.57	53.98	24.41	15000.0	9.000	L1	10.0
0.386714	32.18	---	58.13	25.95	15000.0	9.000	L1	10.1
0.386714	---	22.42	48.13	25.71	15000.0	9.000	L1	10.1
0.472306	32.52	---	56.47	23.95	15000.0	9.000	L1	10.1
0.472306	---	23.95	46.47	22.52	15000.0	9.000	L1	10.1
0.484318	36.28	---	56.27	19.99	15000.0	9.000	L1	10.1
0.484318	---	26.03	46.27	20.23	15000.0	9.000	L1	10.1
0.605628	31.69	---	56.00	24.31	15000.0	9.000	L1	10.1
0.605628	---	22.67	46.00	23.33	15000.0	9.000	L1	10.1
0.750078	31.17	---	56.00	24.83	15000.0	9.000	L1	10.1
0.750078	---	23.10	46.00	22.90	15000.0	9.000	L1	10.1
3.125094	29.59	---	56.00	26.41	15000.0	9.000	L1	10.3
3.125094	---	21.24	46.00	24.76	15000.0	9.000	L1	10.3
16.596221	32.43	---	60.00	27.57	15000.0	9.000	L1	10.8
16.596221	---	31.45	50.00	18.55	15000.0	9.000	L1	10.8
17.600316	31.11	---	60.00	28.89	15000.0	9.000	L1	10.8
17.600316	---	30.10	50.00	19.90	15000.0	9.000	L1	10.8
19.614573	32.13	---	60.00	27.87	15000.0	9.000	L1	10.8
19.614573	---	31.22	50.00	18.78	15000.0	9.000	L1	10.8

1.5 Radiated emissions of intentional radiators

1.5.1 Radiated emissions from unlicensed wireless devices below 30 MHz

- ☒ No deviation from the standard*
☐ Deviation from the standard*
☐ Test not requested*
☐ Test not carried out*

*

Measurement procedure:

Rules and specification

47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)

Guide

ANSI C63.10-2013

The radiated magnetic fields are measured in a frequency range from 9 kHz to 30 MHz. For this purpose, a shielded active loop antenna is used, which is directly connected to a receiver according to CISPR 16 specifications. For the measurement, the loop antenna is successively aligned once parallel to the DUT and once perpendicular to the DUT. The center of the loop antenna is 1 m above the ground. This setup is also used to determine the spectrum of intentional radiators.

The test is performed at a distance of 3 m between the antenna and the EUT in the frequency range up to 30 MHz. A Quasi-Peak or Average-Detector is used, depending on the frequency range. The Average-Detector is used in the frequency bands 9-90 kHz and 110-490 kHz, otherwise the quasi-peak is determined. For pulse modulated devices with a pulse repetition frequency of 20 Hz or less, the Peak-Detector is used (§15.35a Note).

To speed up the measurement process, a pre-measurement is performed with the Peak- and Average-Detectors. The spectrum is determined by rotating the EUT by 360° and the antenna orientation changed accordingly. The maxhold function is used. Hand-held or body-worn devices are rotated through three orthogonal axes to determine maximum emanation. Also the placement and layout of the equipment and the cables are arranged to maximize the disturbance level.

For the re-measurement, the 10 frequencies with the highest exceedance or the smallest distance to the limit are selected. The Average and Quasi-Peak-Detectors are used for the final measurement. Depending on the limit lines, 6 final measurements are documented. The highest limit exceeding or, in case of compliance with the limit, the emissions found with the smallest distance to the limit are documented.

If less than six emission frequencies with a distance of 20 dB are below the limit value, the noise level of the measuring device at representative frequencies is indicated.



The final measurement is performed at a test distance of 3 m. In case the regulation requires testing at different distances, the result is extrapolated by an extrapolation factor 40 dB / decade to the required distance.

Frequency, the measured value, antenna information and the limit will be printed out.

The reported test results are calculated using the following formula to normalize the results for the requested test distance:

$$E_{(f)} \text{ (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)} + 40 \cdot \log(D_T/D_R) \text{ (dB)}$$

$E_{(f)}$ =	Electric field strength at the test frequency
Reading =	Uncorrected measured value
AF =	Correction factor for the antenna
CF =	Correction factor for the cable loss
D_T =	Test distance
D_R =	Reference distance for the limit defined in the standard

Example:

Test frequency	13.56 MHz
Reading	31.5 dB μ V
$AF_{(13.56 \text{ MHz})}$	20.1 dB/m
$CF_{(13.56 \text{ MHz})}$	0.4 dB
D_T	3 m
D_R	30 m

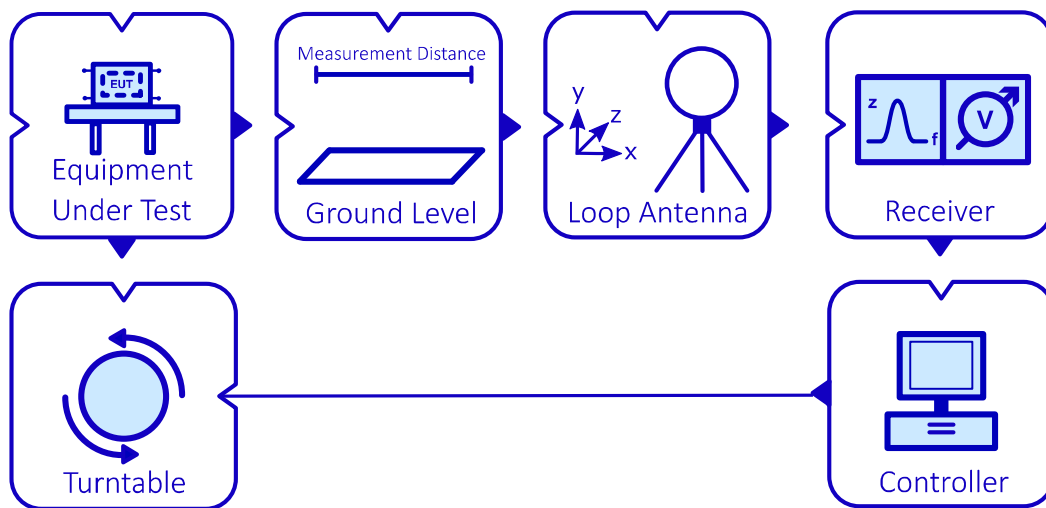
Calculated final result for the field strength (dB μ V/m):

$$E_{(13.56 \text{ MHz})}[30 \text{ m}] = 31.5 \text{ dB}\mu\text{V} + 20.1 \text{ dB/m} + 0.4 \text{ dB} + 40 \cdot \log(3/30) \text{ dB} = 12.0 \text{ dB}\mu\text{V/m}$$



Basic structure - Setup

OATS

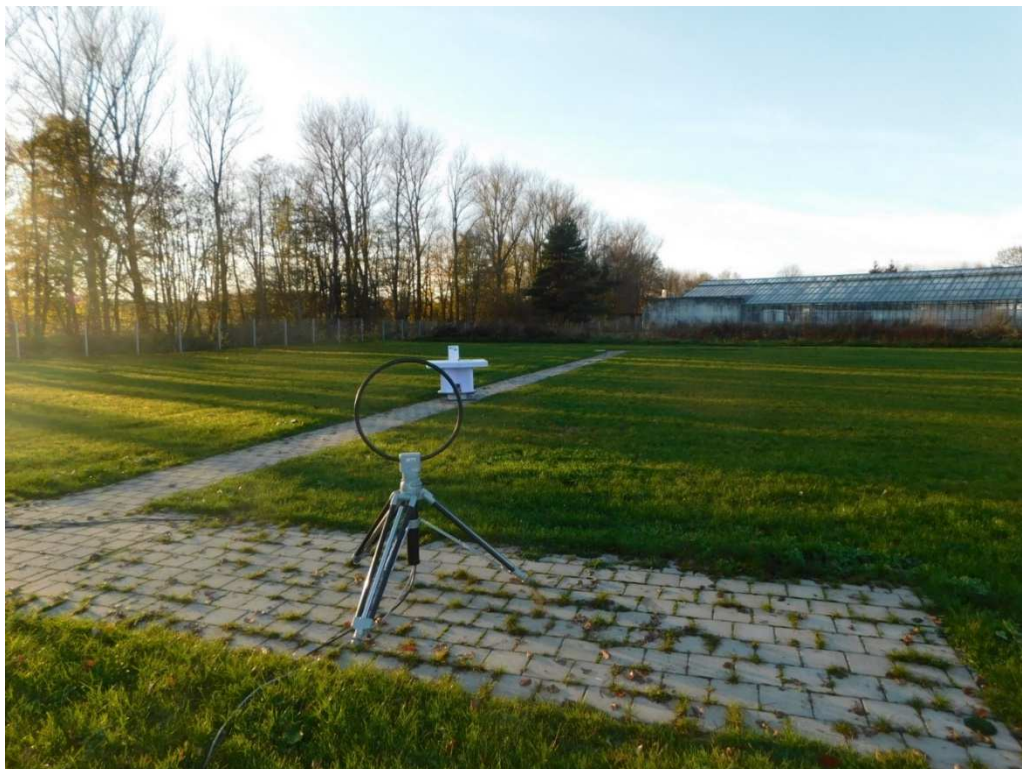




1.5.1.1 Test set up

According ANSI C63.10-2013

Test setup 10 m – Antenna orientation parallel





Test setup 10 m – Antenna orientation orthogonal

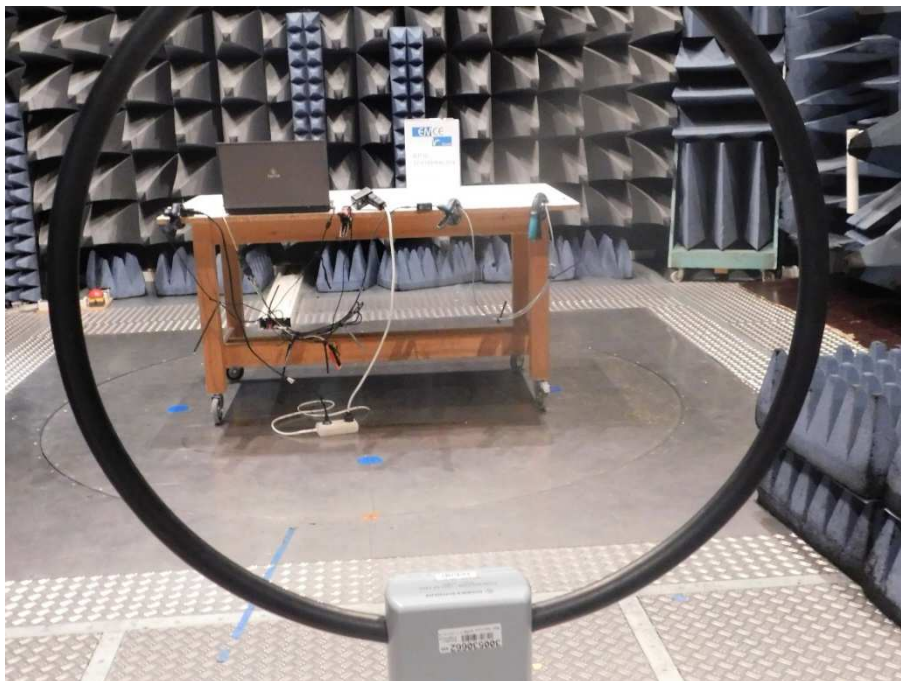


Test setup – EUT Z-Direction

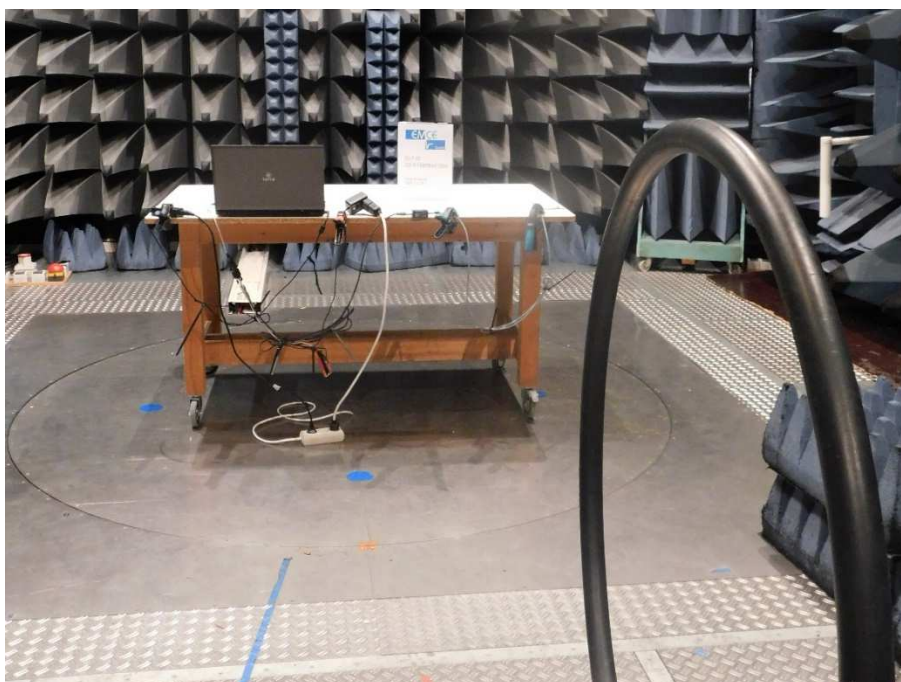




Pre-compliance test setup
Test setup 3 m – Antenna orientation parallel



Test setup 3 m – Antenna orientation orthogonal



Test location

Pre-compliance test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Final test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	n/a	Open area test site without metallic mesh	3/10/30 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

Pre-compliance test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	008	Antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
☒	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
☒	997	Software	EMC32	Rohde & Schwarz	n/a

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
☒	008	Antenna 9 kHz – 30 MHz	HFH2-Z2	Rohde & Schwarz	835776/0002
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
☒	229	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	845420/0005
	997	Software	EMC32	Rohde & Schwarz	n/a

All used test equipment are checked resp. calibrated periodically.

☒ Test equipment was checked and complied to the requirements



Test-/Measurement uncertainty

The measurement uncertainty in the test met the guideline of CISPR16-4-2 or better.

Measurement uncertainty of the radiated emission with an extended coverage factor of $k = 2$:

Frequency	Measurement uncertainty
9 kHz – 30 MHz	on request

1.5.1.2 Test

Rules and specification 47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)

Frequency range: 9 kHz – 30 MHz

Limits for radiated emissions

Technical requirements			
Detector	Frequency / MHz	Limit / $\mu\text{V/m}$	Measurement distance / m
AV	0.009 – 0.09	2400/F(kHz)	300
QP	0.09 – 0.110	2400/F(kHz)	300
AV	0.110 – 0.49	2400/F(kHz)	300
QP	0.49 – 1.705	24000/F(kHz)	30
QP	1.705 – 30.0	30	30
For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz			

Antenna Orientation

☒ Parallel to EUT ☒ Orthogonal to EUT

Antenna Height

☒ 1 m - Loop center above ground

Antenna Distance - EUT

☒ 3 m (Pre-test) ☒ 10 m (Final test) ☐ 30 m

EUT Orientation to Antenna

☐ X-Axis ☐ Y-Axis ☒ Z-Axis

Rationale for selecting the EUT test set up

Equipment units:

EUT with external antenna, external power supply and evaluation unit.
Antenna orientation in Z-Axis for emission worst case conditions.

Operation mode

EUT arrangement: ☒ Tabletop ☐ Floor standing
Power supply: ☒ 120 V/60 Hz ☐ Internal battery

Continuous operation with the maximum permitted reading speed according customer specification. The reader was operated without a tag.

Environmental conditions

Temperature [10 – 40 °C]: 15 °C
Relative humidity [10 – 90 %]: 53 %

Environmental conditions during the test: ☒ kept ☐ not kept

Test result

Limits for unwanted radiated emissions: ☒ kept ☐ not kept

| Remarks: n/a

Records

Pre-compliance measurement

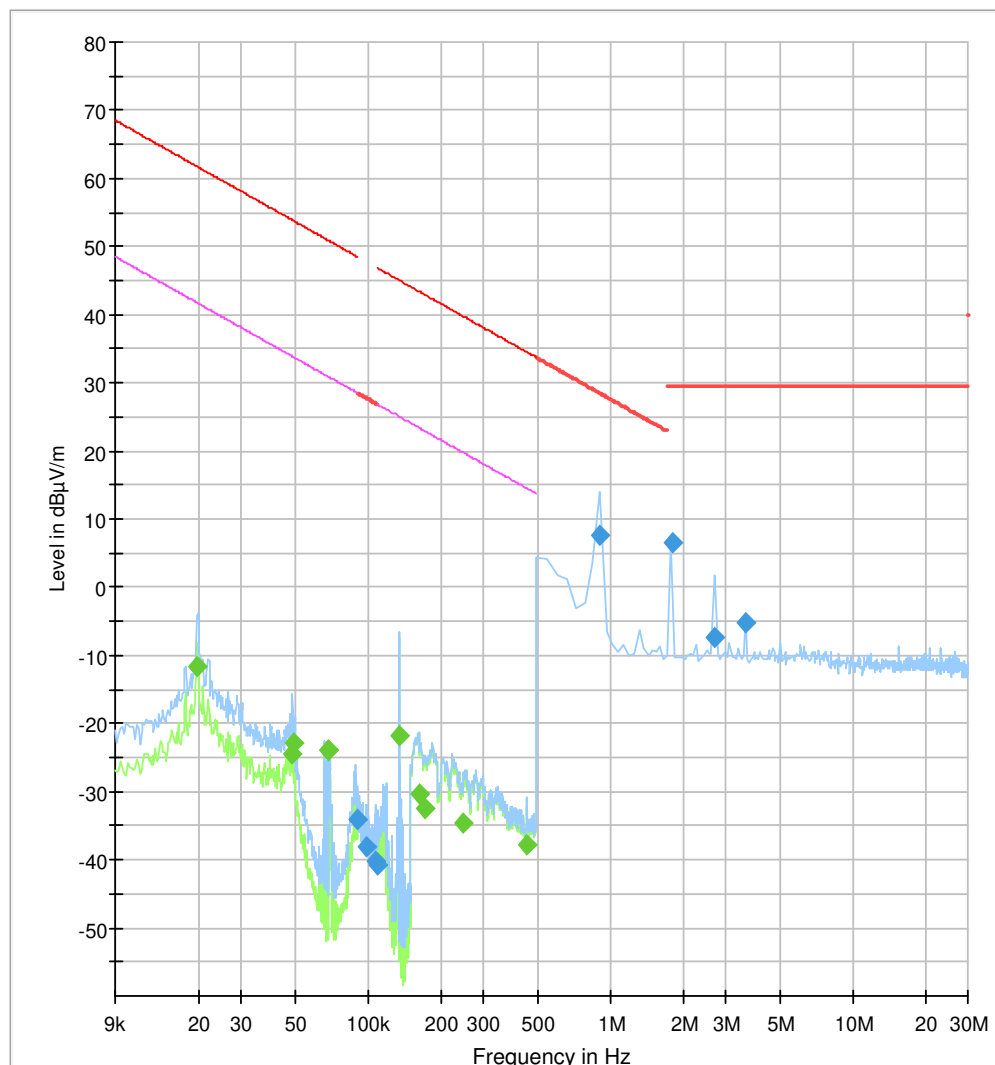
☒ Readings
☒ Diagram

Final measurement

☒ Readings
☐ Diagram

EUT Information

EUT Name:	ARE i9x - hdx - SEMI
Test_ID: / SN:	22-0188PR46-004
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with max perm. customer reading speed, no Tag
Test specification:	47 CFR Part 15 Subpart C Section 15.209
Antenna information:	Distance EUT-Ant.: 3.0 m / Pol.: Parallel/Orthogonal / Ant.Height: 1.0 m.
Operator:	Chr. Vogelmann
File #:	22-0188RC47-004-014
Comment #1:	Supply voltage 120 V / 60 Hz
Comment #2:	Test results normalized to requested test distance according Section 15.209



— Preview Result 2-AVG	— Preview Result 1-PK+
— 47 CFR Part 15 Subpart C Section 15.209 QPK	— 47 CFR Part 15 Subpart C Section 15.209 AV
— 47 CFR Part 15 Subpart C Section 15.209 PK+	◆ Final_Result QPK
◆ Final_Result AVG	

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)	Corr. (dB/m)
0.019715	---	-11.68	41.71	53.39	5000.0	0.200	Parallel	115.0	-59.8
0.048636	---	-24.53	33.87	58.40	5000.0	0.200	Parallel	309.0	-59.9
0.048780	---	-22.73	33.84	56.57	5000.0	0.200	Parallel	20.0	-59.9
0.067944	---	-23.91	30.96	54.88	5000.0	0.200	Parallel	78.0	-60.0
0.067964	---	-24.03	30.96	54.99	5000.0	0.200	Parallel	190.0	-60.0
0.090185	-34.11	---	28.50	62.61	5000.0	0.200	Parallel	200.0	-60.0
0.098483	-38.05	---	27.74	65.79	5000.0	0.200	Parallel	76.0	-60.0
0.107557	-40.18	---	26.98	67.15	5000.0	0.200	Parallel	199.0	-60.0
0.109767	-40.65	---	26.80	67.45	5000.0	0.200	Parallel	183.0	-60.0
0.134244	---	-21.77	25.02	46.79	5000.0	0.200	Parallel	90.0	-60.0
0.161601	---	-30.31	23.44	53.75	5000.0	9.000	Parallel	-5.0	-60.0
0.172224	---	-32.60	22.89	55.49	5000.0	9.000	Parallel	316.0	-60.0
0.245852	---	-34.65	19.79	54.44	5000.0	9.000	Parallel	315.0	-60.0
0.450250	---	-37.93	14.54	52.46	5000.0	9.000	Parallel	279.0	-60.1
0.905070	7.48	---	28.47	20.99	5000.0	9.000	Orthogonal	256.0	-20.0
1.807776	6.51	---	29.54	23.03	5000.0	9.000	Orthogonal	346.0	-19.9
2.714890	-7.27	---	29.54	36.81	5000.0	9.000	Orthogonal	264.0	-19.9
3.614209	-5.19	---	29.54	34.73	5000.0	9.000	Parallel	299.0	-19.9



Test result - fundamental

Frequency	Field strength	Limit _{10m}	Margin	Ant.-	Ant.-	Detector	Receiver	Supply voltage	Remarks
				Distance	Orientation	Peak / QP / AV	6dB BW		
MHz	dBµV/m	dBµV/m	dB	m	H/V		kHz		
0.134244	26.4	84.1	57.7	10.0	Parallel	AV	0.2	7.2VDC	
	40.7	104.1	63.4			PK			

Limit_{10m} Limit calculated for 10m test distance



1.5.2 Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz

- ☒ No deviation from the standard
- ☐ Deviation from the standard*
- ☐ Test not requested*
- ☐ Test not carried out*

*

Measurement procedure:

Rules and specification
Guide

47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)
ANSI C63.10-2013

The radiated interference emission is measured on an alternative open area test site OATS in the frequency range 30 - 1000 MHz. The measurement distance is 3 m or 10 m, depending on the standard. Above 1 GHz, the measurement is performed in a 3 m semi-anechoic chamber with floor absorber to reduce ground reflections. For the measurement of the field strength a biconical antenna up to 200 MHz, a logperiodic antenna from 200 MHz to 1 GHz and horn antennas or double stacked logperiodic antenna above 1 GHz are used. All antennas are linearly polarized. External low-noise preamplifiers are used in the range above 1 GHz to improve measurement sensitivity. Special measures, such as filters or attenuators, are taken to avoid overloading the amplifiers. The antenna height is varied between 1 m and 4 m as required. The elevation angle of the antenna can be corrected via the antenna mast to ensure that the main lobe of the antenna is always directed at the EUT. A turntable allows the alignment of the EUT towards the antenna to maximize the radiated emission. The test sites are located above a metallic ground plane. Table-top devices are placed on a non-conductive wooden table. Hand-held, body-worn, or ceiling-mounted devices are examined in 3 orthogonal axis orientations to determine the maximum emission level. Floor-standing devices are placed directly on the grounded metal turntable/reference insulated from ground plane by an insulating material <12 mm.

During an initial automated pre-test run in a semi-anechoic chamber, the desired frequency range is measured. The receiver is operated as an analyzer and the frequency ranges are run sequentially depending on the antenna. For the measurement, the turntable is continuously rotated from 0° - 360° and back, and the antenna height is changed in 0.5 m increments after each complete turntable cycle. The antenna position is then changed from 1.0 m to 4.0 m in 0.5 m steps for vertical polarization and back for horizontal polarization. During a cycle, the frequency range is continuously swept with peak detector and max hold function. Depending on the test specification, an average detector is also used if required. For each discrete antenna polarization over all positions, the maximum peak values



are recorded with frequency, level, turntable position, antenna height and antenna polarization. Significant peaks or clock frequencies are marked and re-measured with increased frequency accuracy. The recordings are used to determine the exact frequency and to optimize the interference level. At the predefined position, the turntable position is fine-adjusted in the range of $\pm 20^\circ$ and then the antenna height is varied by ± 0.3 m. At the maximized position, the emission is measured with quasi-peak or average detector and listed. The six highest emissions are selected for final measurement in the OATS.

In a final test run, an open area test site measurement is made at selected frequencies determined by the previous test procedure. For each selected frequency, the frequency setting is optimized again in the OATS and the field strength value is maximized, rotating the EUT 360° at an antenna height of 1.0 m for vertical antenna polarization and 2.0 m for horizontal antenna polarization. At the azimuth position of the EUT for the highest radiation, the antenna height is varied within 1.0 m and 4.0 m until the highest interference level is reached. To maximize the interference level at the determined position, the turntable azimuth is fine-adjusted by $\pm 45^\circ$ and the antenna height is fine-adjusted by ± 0.3 m. The setup of the instrument and the cables are manipulated within the range to produce the highest emission.

Final measurement is made using a receiver conforming to CISPR 16 guidelines with a quasi-peak and average detector.

The identified frequency and amplitude of the six highest radiated emissions relative to the limit lines are listed. If fewer than six emission frequencies are within 20 dB of the limit, the noise level of the instrument at representative frequencies is reported. For documentation of final testing below 1 GHz on the OATS the plots recorded in den SAC are indicated as pre-compliance.

In case the regulation requires testing at different distances, the result is extrapolated by an extrapolation factor 20 dB / decade to the required distance.

The reported test results are calculated using the following formula to normalize the results to the requested test distance:

$$E_{(f)} \text{ (dB}\mu\text{V/m)} = \text{Reading (dB}\mu\text{V)} + \text{AF (dB/m)} + \text{CF (dB)} + 20 \cdot \log(D_T/D_R) \text{ (dB)}$$

$E_{(f)}$ =	Electric field strength at the test frequency
Reading =	Uncorrected measured value
AF =	Correction factor for the antenna
CF =	Correction factor for the cable loss
D_T =	Test distance
D_R =	Reference distance for the limit defined in the standard

Example:

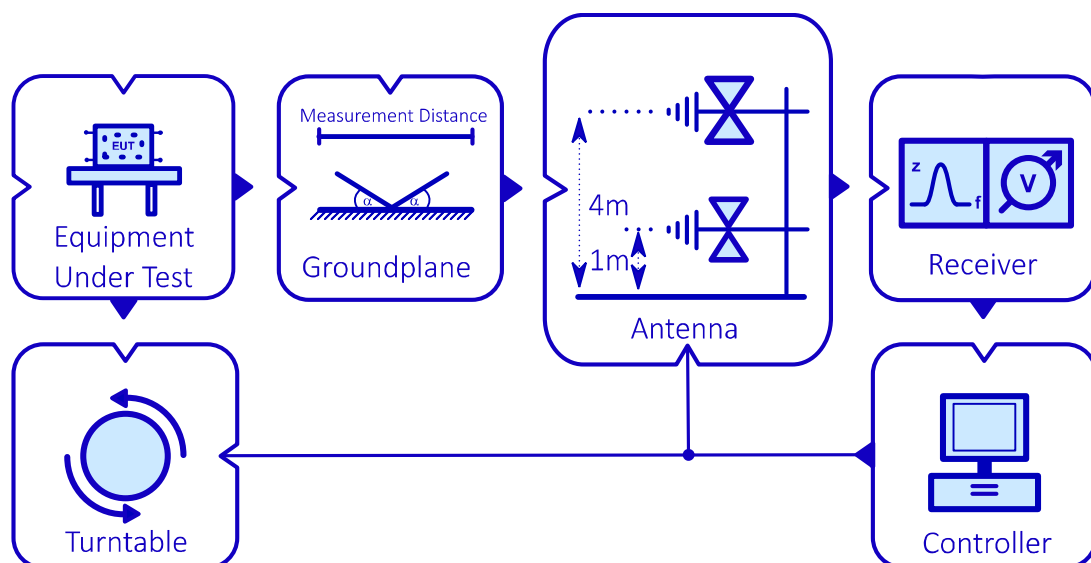
Test frequency	216.0 MHz
Reading	22.5 dB μ V
$AF_{(216 \text{ MHz})}$	10.9 dB/m
$CF_{(216 \text{ MHz})}$	0.9 dB
D_T	3 m
D_R	10 m

Calculated final result for the field strength (dB μ V/m):

$$E_{(216 \text{ MHz})}[10 \text{ m}] = 22.5 \text{ dB}\mu\text{V} + 10.9 \text{ dB/m} + 0.9 \text{ dB} + 20 \cdot \log(3/10) \text{ dB} = 23.8 \text{ dB}\mu\text{V/m}$$

Basic structure - Setup

OATS / SAC





1.5.2.1 Test set up

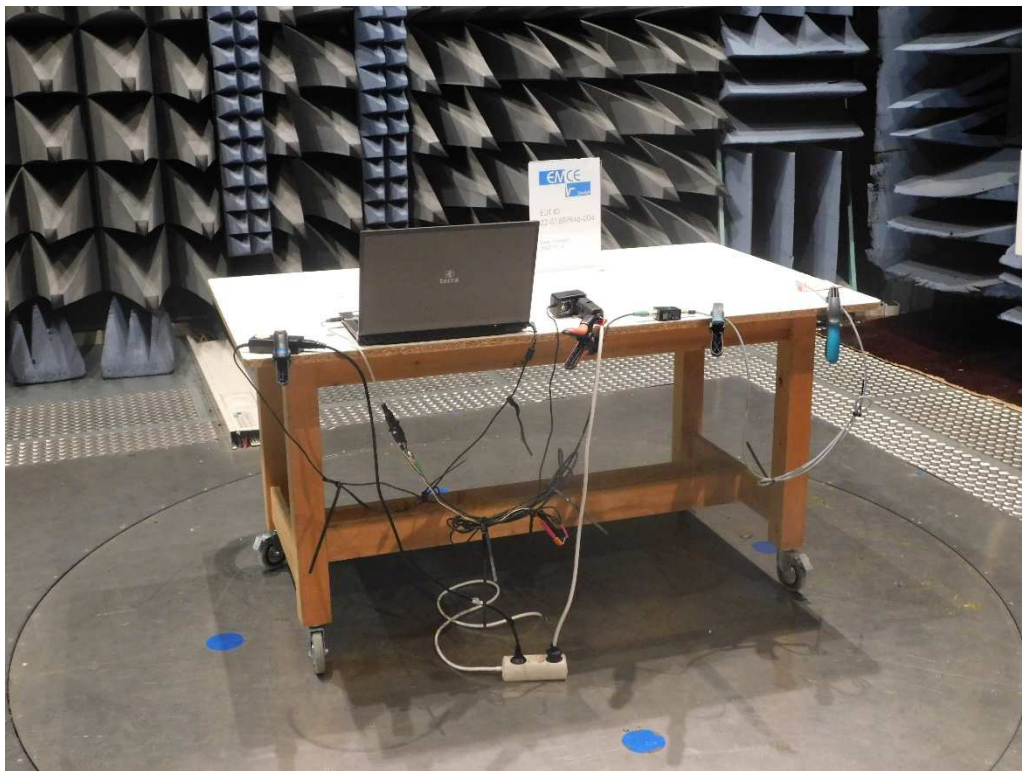
According ANSI C63.10-2013

Final test setup





Pre-test setup



Test location

Pre-compliance test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
☒	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Final test					
☒	Inv.-No.	Designation	Type (L x W x H)	Manufacturer	Location
	062	Semi anechoic chamber # 2	13.5 x 6.1 x 5.5 m	EMC-Technik & Consulting GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
	014	Open area test site	10 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden
☒	015	Open area test site	3 m	EMCE GmbH	EMCE GmbH Untere Wiesen 1 88483 Burgrieden

Used test equipment

Pre-compliance test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
☒	011	Antenna	VHBA9123 / BBA9106 30 – 300 MHz	Schwarzbeck	0408/94
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
☒	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	059	Logper. Antenna	HL050	Rohde & Schwarz	100006
☒	997	Software	EMC32	Rohde & Schwarz	n/a
☒	8008	Logarithmic Periodic Broadband Antenna	VULP 9118A 180 - 1500 MHz	Schwarzbeck	900

Final test					
☒	Inv.-No.	Designation	Type	Manufacturer	S/N
	001	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	833776/008
☒	009	Antenna	VHBA9123 / BBA9106 30 – 300 MHz	Schwarzbeck	435
☒	042	AC-Source / Analyzer / Norm impedance	EMV D5000/PAS	Spitzenberger + Spies	A274700/ 0 0501
	058	Test receiver	ESIB 40	Rohde & Schwarz	100200
	059	Logper. Antenna	HL050	Rohde & Schwarz	100006
	222	Broadband Preamplifier	BBV 9718 0.5-18GHz	Schwarzbeck	9718-316
	226	Log.-per. antenna	HL050	Rohde & Schwarz	100829
☒	229	Test receiver	ESS 5 Hz – 1000 MHz	Rohde & Schwarz	845420/0005
	236	Broad-Band Horn Antenna	BBHA 9120 E 0.5-6 GHz	Schwarzbeck	00831
	239	Broadband Horn Antenna	BBHA 9170 15-40 GHz	Schwarzbeck	00932
	997	Software	EMC32	Rohde & Schwarz	n/a
	8004	Broadband Preamplifier	BLMA 1840-5G 18-40 GHz	BONN Elektronik GmbH	2113300
☒	8007	Logarithmic Periodic Broadband Antenna	VULP 9118A 180 - 1500 MHz	Schwarzbeck	899



All used test equipment are checked resp. calibrated periodically.

☒ Test equipment was checked and complied to the requirements

Test-/Measurement uncertainty

The measurement uncertainty in the test met the guideline of CISPR16-4-2 or better.

Measurement uncertainty of the radiated emission with an extended coverage factor of $k = 2$:

Frequency	Measurement uncertainty
30 MHz – 200 MHz	4.8 dB (valid for 10 m-OATS)
200 MHz – 1 GHz	4.9 dB (valid for 10 m-OATS)
30 MHz – 200 MHz	4.8 dB (valid for 3 m-OATS)
200 MHz – 1 GHz	6.2 dB (valid for 3 m-OATS)

1.5.2.2 Test

Rules and specification 47 CFR Part 15 Section 15.209 (a)(b)(c)(d)(e)(f)

Highest frequency generated or used in the device or on which the device operates or tunes:

☒ <10 GHz

☐ 10 GHz – 30 GHz

☐ 30 GHz – 95 GHz

☐ ≥95 GHz

Upper frequency of measurement:

☒ 10. harmonic of the highest frequency or 40 GHz, whichever is lower

☐ 5. harmonic of the highest frequency or 100 GHz, whichever is lower

☐ 5. harmonic of the highest frequency or 200 GHz, whichever is lower

☐ 3. harmonic of the highest frequency or 750 GHz, whichever is lower

Frequency range:

☒ 30 MHz – 1 GHz

☐ 5 – 18 GHz

☐ 26 – 40 GHz

☐ 1 – 5 GHz

☐ 18 – 26 GHz

Limits for radiated emissions

Technical requirements			
Detector	Frequency / MHz	Limit / dBμV/m	Measurement distance / m
QP	30.0 – 88.0	40.0	3
QP	88.0 – 216.0	43.5	3
QP	216.0 – 960.0	46.0	3
QP	960.0 – 1000.0	54.0	3
AV	> 1000	54.0	3
PK	> 1000	74.0	3

The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.



Rationale for selecting the EUT test set up

Equipment units:

EUT with external antenna, external power supply and evaluation unit.
Antenna orientation in Z-Axis for emission worst case conditions.

EUT Orientation

☐ X-Direction

☐ Y-Direction

☒ Z-Direction

Operation mode

EUT arrangement:

☒ Tabletop

☐ Floor standing

Power supply:

☒ 120 V/60 Hz

☐ Internal battery

Continuous operation with the maximum permitted reading speed according customer specification. The reader was operated without a tag.

Environmental conditions

Temperature [10 – 40 °C]:

14 °C

Relative humidity [10 – 90 %]:

53 %

Environmental conditions during the test:

☒ kept

☐ not kept

Test result

Limits for unwanted radiated emissions:

☒ kept

☐ not kept

| Remarks: n/a



Records

Pre-test measurement



Readings



Diagram

Final measurement



Readings

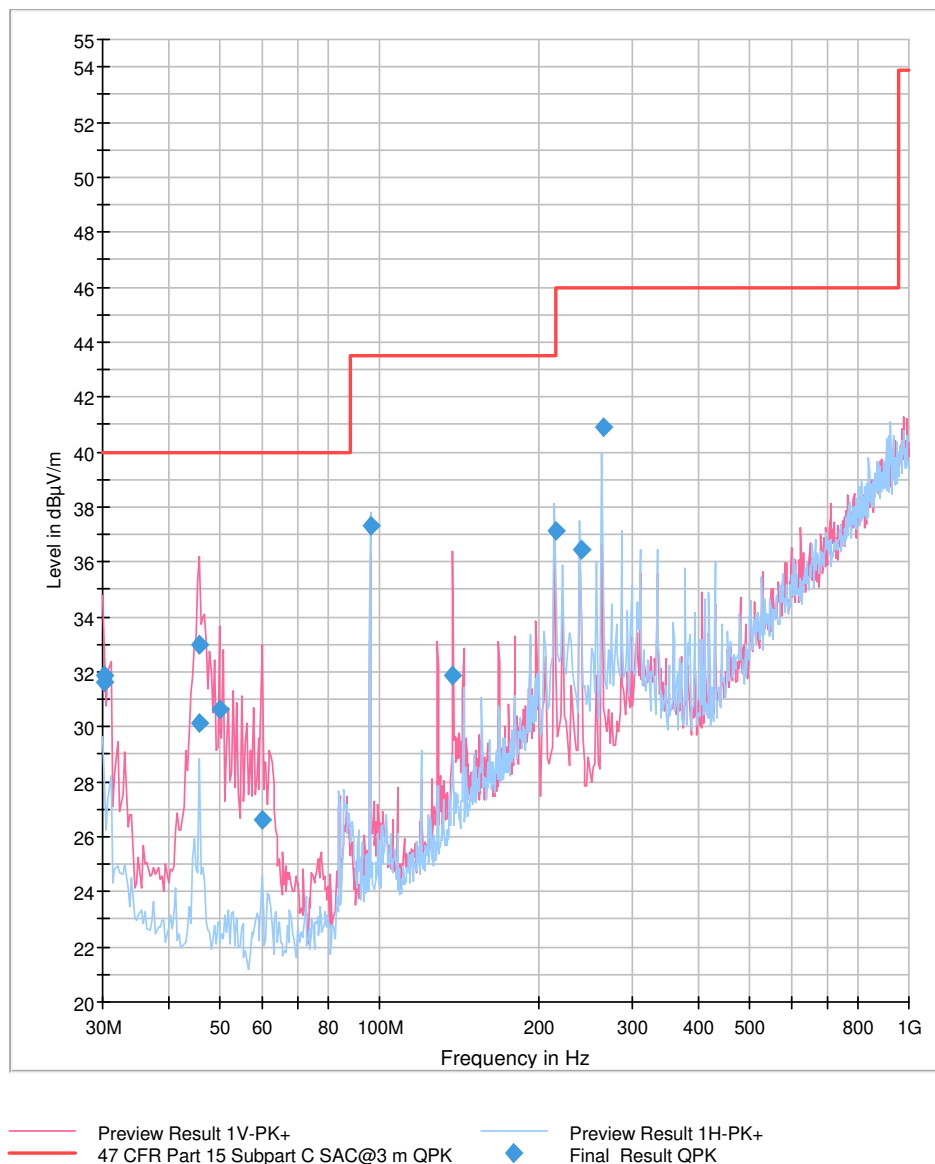


Diagram

Pre-test measurement

EUT Information

EUT Name:	ARE i9x - hdx - SEMI
Test_ID: / SN:	22-0188PR47-004
Customer:	AEG Identifikationssysteme GmbH
Operational condition:	Continuous reading with max perm. customer reading speed, no Tag
Test specification:	47 CFR Part 15 Subpart C Section 15.209 - SAC@3 m
Antenna information:	Distance EUT-Ant.: 3.0 m / Polarisation: H/V / Ant.Height: 1.0-4.0 m.
Operator:	S. Vogelmann
File #:	22-0188RC47-004-013
Comment #1:	Supply voltage 120 V / 60 Hz
Comment #2:	



Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
30.169574	31.60	40.00	8.40	5000.0	120.000	108.0	V	201.0	12.5
30.172345	31.86	40.00	8.14	5000.0	120.000	125.0	V	245.0	12.5
45.731463	30.13	40.00	9.87	5000.0	120.000	225.0	V	190.0	9.1
45.787576	32.99	40.00	7.01	5000.0	120.000	166.0	V	312.0	9.1
49.803607	30.64	40.00	9.36	5000.0	120.000	130.0	V	338.0	8.8
59.935872	26.62	40.00	13.38	5000.0	120.000	235.0	V	126.0	8.5
95.959920	37.34	43.50	6.16	5000.0	120.000	204.0	H	-2.0	10.0
137.322646	31.89	43.50	11.61	5000.0	120.000	135.0	V	55.0	12.4
215.907816	37.13	43.50	6.37	5000.0	120.000	261.0	H	338.0	11.9
239.907816	36.47	46.00	9.53	5000.0	120.000	126.0	H	10.0	12.0
263.899800	40.89	46.00	5.11	5000.0	120.000	166.0	H	10.0	12.9



Final measurement

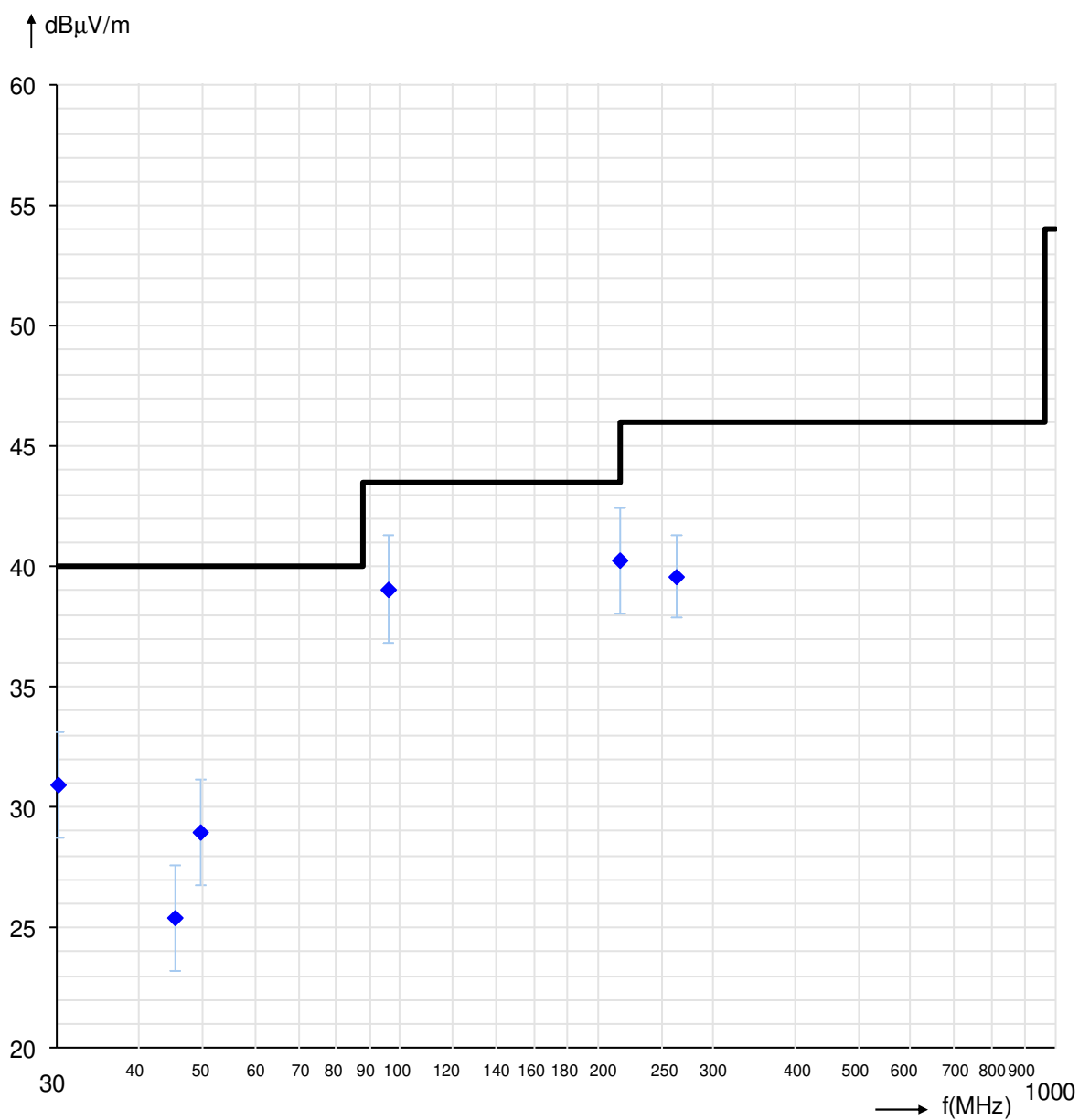
Readings – Antenna horizontal / vertical polarized

Frequency	Readings	+ AF Antenna correction factor	+ KF Cable correction factor	Field strength	Limit	Margin	Antenna- Polarisation	Antenna- Height	Turn Table. Position
MHz	dB μ V	dB/m	dB	dB μ V/m	dB μ V/m	dB	hor./ver.	m	Deg.
30.200	18.2	12.1	0.6	30.9	40.0	9.1	V	1.22	270
45.260	15.9	8.8	0.7	25.4	40.0	14.6	V	1.10	90
49.800	19.7	8.4	0.8	28.9	40.0	11.1	V	1.10	270
95.960	28.6	9.4	1.1	39.1	43.5	4.4	H	2.25	0
215.840	27.6	11.0	1.7	40.3	43.5	3.2	H	1.20	45
263.890	25.8	11.9	1.9	39.6	46.5	6.9	H	1.20	10



Diagram radio disturbances – Antenna horizontal / vertical polarized

Limit: 47 CFR Part 15 Section 15.209 @3 m



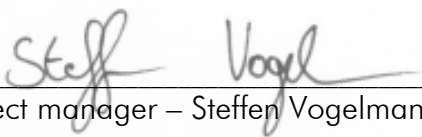
2 Summary

47 CFR Part 15 Subpart C

Requirement	Regulation section	Result	Remarks
Antenna requirement	§ 15.203	Pass	n/a
Restricted bands of operation	§ 15.205 (a) (b) (c)	Pass	n/a
Terminal voltage on AC power-line	§ 15.207 (a)	Pass	n/a
Radiated emissions from unlicensed wireless devices below 30 MHz	§ 15.209 (a) (b) (c) (d) (e) (f)	Pass	n/a
Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz	§ 15.209 (a) (b) (c) (d) (e) (f)	Pass	n/a

Burgrieden, 2023-01-10

Responsible inspector:


Project manager – Steffen Vogelmann

- End of Test Report -